Stephen F. Austin State University
Department of Mathematics
Differential Equations (MATH 3330-001)
Syllabus & Course Policy

Instructor details:
Dr. Md Istiaq Hossain
Office Phone: (936)-468-1702
E-mail: hossainm2@sfasu.edu
Class Schedule: TR 8.00-9.15 AM, Math Building Room 214
Student Hours: MWF 10.00 - 11.00 AM, TR 09.30 - 10.30 AM (or by appointment)

Course Description: Solving of differential equations of physics, chemistry and engineering, and a study of the characteristics of the solutions.

Necessary Materials:

- **Textbook**: *The Ordinary Differential Equations Project*, by Thomas W. Judson, available online. There is a PDF available online but you can access the most recent version through [Runestone Academy](http://www.runestoneacademy.com).

Withdrawal: The last day to withdraw from a full-session course with a grade of W is April 24, 2023. Note: You can find the withdrawal dates and procedures on [here](#) and [here](#).

Make-up and Late-work Policies: No make-ups are allowed without prior discussion beforehand with the instructor, or in case of emergency. If there are concerns with completing any work on-time or being prepared for an exam please contact the instructor immediately. The decision of a make-up or accepting late work is left to the discretion of the instructor and is final.

Grading Categories and Weights:

1. **Reading/Preparation questions**: This reading/prep assessments will be assigned through Runestone Academy course. These are going to be mostly reading questions that are typically due before the beginning of each class. It will be graded on a scale of 0 to 2 where 0 will be assigned for no attempt, 1 will be assigned for a decent response, and full 2 points for correct procedure and answer. **The reading/prep questions will be worth a total of 5% of your final grade**.

2. **Homework**: There will be a set of weekly homework questions picked from various sources. This may include solving problems using pen/pencil and paper, using SageMath (SageMath is a computer algebra system) verifying the analytical solutions and drawing solution functions, etc. **The weekly homework will be worth 20% of your final grade**.

3. **Quizzes**: At the beginning of class the instructor reserves the right to present a question or two on the board/projector/paper and you will have the first fifteen/twenty minutes of class to answer the question and turn in your work. Quiz questions will be based off of the previous day’s work. Quizzes will be graded out of 2 points, 1 point for attempting the question, and
1 point if the answer is correct. The top 15 quizzes will be kept for the final grade. **Quizzes will be worth a total of 15% of your final grade.**

(4) **Unit Exams:** There will be two one-hour exams, each exam is worth twenty percent of the grade. The exams will be given in class. You may find dates on the tentative schedule, note that dates may change due to pace of course. The first and second exams will be worth 15% each, respectively with a total of 30%. No test scores will be dropped.

(5) **Projects:** Halfway through the semester, once we understand the basic structure of a homework, we will begin asking a set of questions particular to one or more modeling problems. This will be done using a Latex/Overleaf template provided by the instructor which will also need incorporating outputs and figures from SageMath along the typesetting of analytic solution. **The project(s) will be worth 10% of your final grade.**

(6) **Final Exam:** The Final exam will be a comprehensive exam worth 20%.

**Grading Scale:**

<table>
<thead>
<tr>
<th>Grade</th>
<th>Percentage</th>
</tr>
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<tbody>
<tr>
<td>A</td>
<td>90-100%</td>
</tr>
<tr>
<td>B</td>
<td>80-89.99%</td>
</tr>
<tr>
<td>C</td>
<td>70-79.99%</td>
</tr>
<tr>
<td>D</td>
<td>60-69.99%</td>
</tr>
<tr>
<td>F</td>
<td>0-59.99%</td>
</tr>
</tbody>
</table>

**Tentative Semester Schedule:**

<table>
<thead>
<tr>
<th>Week#/Day</th>
<th>Tuesday</th>
<th>Thursday</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 1</td>
<td>Aug 29 (1.1)</td>
<td>31 (1.1/1.2)</td>
</tr>
<tr>
<td>Week 2</td>
<td>5 (1.3)</td>
<td>7 (1.4)</td>
</tr>
<tr>
<td>Week 3</td>
<td>12 (1.5)</td>
<td>14 (1.6)</td>
</tr>
<tr>
<td>Week 4</td>
<td>19 (1.6/1.7)</td>
<td>21 (1.7)</td>
</tr>
<tr>
<td>Week 5</td>
<td>26 (Review)</td>
<td>28 (Exam 1)</td>
</tr>
<tr>
<td>Week 6</td>
<td>Oct 3 (2.1)</td>
<td>5 (2.2)</td>
</tr>
<tr>
<td>Week 7</td>
<td>10 (2.3)</td>
<td>12 (2.3)</td>
</tr>
<tr>
<td>Week 8</td>
<td>17 (3.1)</td>
<td>19 (3.2)</td>
</tr>
<tr>
<td>Week 9</td>
<td>24 (3.3)</td>
<td>26 (3.4)</td>
</tr>
<tr>
<td>Week 10</td>
<td>31 (3.5)</td>
<td>Nov 2 (Review)</td>
</tr>
<tr>
<td>Week 11</td>
<td>7 (Exam 2)</td>
<td>9 (3.4)</td>
</tr>
<tr>
<td>Week 12</td>
<td>14 (4.1)</td>
<td>16 (4.2)</td>
</tr>
<tr>
<td>Week 13</td>
<td>21 (TG.B)</td>
<td>23 (TG.B)</td>
</tr>
<tr>
<td>Week 14</td>
<td>28 (4.3)</td>
<td>30 (5.1)</td>
</tr>
<tr>
<td>Week 15</td>
<td>5 (Review)</td>
<td>7 (Review)</td>
</tr>
<tr>
<td>Week 16</td>
<td>12 (Final @8.00 AM)</td>
<td>14</td>
</tr>
</tbody>
</table>

No class days: TG.B – Thanksgiving Break
Academic Integrity (4.1): [The Code of Student Conduct and Academic Integrity] outlines the prohibited conduct by any student enrolled in a course at SFA. It is the responsibility of all members of all faculty, staff, and students to adhere to and uphold this policy.

Articles IV, VI, and VII of the new Code of Student Conduct and Academic Integrity outline the violations and procedures concerning academic conduct, including cheating, plagiarism, collusion, and misrepresentation. Cheating includes, but is not limited to: (1) Copying from the test paper (or other assignment) of another student, (2) Possession and/or use during a test of materials that are not authorized by the person giving the test, (3) Using, obtaining, or attempting to obtain by any means the whole or any part of a non-administered test, test key, homework solution, or computer program, or using a test that has been administered in prior classes or semesters without permission of the Faculty member, (4) Substituting for another person, or permitting another person to substitute for one’s self, to take a test, (5) Falsifying research data, laboratory reports, and/or other records or academic work offered for credit, (6) Using any sort of unauthorized resources or technology in completion of educational activities.

Plagiarism is the appropriation of material that is attributable in whole or in part to another source or the use of one’s own previous work in another context without citing that it was used previously, without any indication of the original source, including words, ideas, illustrations, structure, computer code, and other expression or media, and presenting that material as one’s own academic work being offered for credit or in conjunction with a program course or degree requirements.

Collusion is the unauthorized collaboration with another person in preparing academic assignments offered for credit or collaboration with another person to commit a violation of any provision of the rules on academic dishonesty, including disclosing and/or distributing the contents of an exam.

Misrepresentation is providing false grades or resumes; providing false or misleading information in an effort to receive a postponement or an extension on a test, quiz, or other assignment for the purpose of obtaining an academic or financial benefit for oneself or another individual or to injure another student academically or financially.

Withheld Grades Semester Grades Policy (5.5): Ordinarily, at the discretion of the instructor of record and with the approval of the academic chair/director, a grade of WH will be assigned only if the student cannot complete the coursework because of unavoidable circumstances. Students must complete the work within one calendar year from the end of the semester in which they receive a WH, or the grade automatically becomes an F. If students register for the same course in future terms the WH will automatically become an F and will be counted as a repeated course to compute the grade point average. For additional information, go to [https://www.sfasu.edu/policies/course-grades-5.5.pdf].

Students with Disabilities: To obtain disability-related accommodations, alternate formats, and/or auxiliary aids, students with disabilities must contact the Office of Disability Services (ODS), Human Services Building, and Room 325, 468-3004 / 468-1004 (TDD) as early as possible in the semester. Once verified, ODS will notify the course instructor and outline the accommodation and/or auxiliary aids to be provided. Failure to request services promptly may delay your accommodations. For additional information, go to [http://www.sfasu.edu/disabilityservices/].
**Student Wellness and Well-Being:** SFA values students overall well-being, mental health and the role it plays in academic and overall student success. Students may experience stressors that can impact both their academic experience and their personal well-being. These may include academic pressure and challenges associated with relationships, emotional well-being, alcohol and other drugs, identities, finances, etc. If you are experiencing concerns, seeking help, SFA provides a variety of resources to support students mental health and wellness. Many of these resources are free, and all of them are confidential.

**On-campus Resources:**

The Dean of Students Office (Rusk Building, 3rd floor lobby)
www.sfasu.edu/deanofstudents
936.468.7249
dos@sfasu.edu

SFA Human Services Counseling Clinic Human Services, Room 202
www.sfasu.edu/humanservices/139.asp
936.468.1041

The Health and Wellness Hub “The Hub”
Location: corner of E. College and Raguet St.
To support the health and well-being of every Lumberjack, the Health and Wellness Hub offers comprehensive services that treat the whole person mind, body and spirit. Services include:

- Health Services
- Counseling Services
- Student Outreach and Support
- Food Pantry
- Wellness Coaching
- Alcohol and Other Drug Education

www.sfasu.edu/thehub
936.468.4008
thehub@sfasu.edu

**Crisis Resources:**

- Burke 24-hour crisis line: 1.800.392.8343
- National Suicide Crisis Prevention: 9-8-8
- Suicide Prevention Lifeline: 1.800.273.TALK (8255)
- Crisis Text Line: Text HELLO to 741-741
Important Notes:

- All exams will count toward your final credit. I generally provide no extra credit.

- Please note that I do not grade “answers” but the work shown and appropriate procedures used that support your claims and lead to the correct solution of a problem. On a written exam you must show a complete and correct work for each problem to ensure full credit. Getting a correct answer without supporting work will result in a minimal partial credit. It is better, in general, to show some correct steps and procedures with incorrect final answer than to give the correct answer without any work.

- It is much better to study in a continuous fashion than to cram before an exam. For each hour of class instruction you should plan on spending at least two hours of your time for studying outside of the class.

- Mathematics should not seem like remembering processes or procedures. If a mathematical step does not make sense to you, reexamine your work.

- It is really important to understand that “Practicing” is the key to your understanding of mathematics and subsequently being successful in the course.

- If you are struggling with the core concept then please seek for help as soon as you can. Regularly coming to your “student hours” and/or seeking help in AARC can be really helpful. In each course that is a prerequisite for another, you need to make a C or better to qualify for subsequent courses. It is up to you to make this happen.

- Make sure to bring any allowed tools you need for success. Cell phones as calculators are NOT allowed on exams and quizzes.

- From the front of the room, it is easy to see what you are doing and how you spend your class time. I am not likely to make any special arrangement for people seeking to improve their grade because they have not used class time wisely.
Math 3330– Differential Equations
Course Syllabus

Course description: Solving of differential equations of physics, chemistry and engineering, and a study of the characteristics of the solutions.

Credit hours: 3

The following is an excerpt from SFA Policy 5.4:

The federal definition of a credit hour is an amount of work represented in intended learning outcomes and verified by evidence of student achievement that is an institutionally established equivalency that reasonably approximates:

1. Not less than one hour of classroom or direct faculty instruction and a minimum of two hours out-of-class student work each week for approximately fifteen weeks for one semester or trimester hour of credit, or 10 to 12 weeks for one quarter hour of credit, or the equivalent amount of work over a different amount of time, or;

2. At least an equivalent amount of work as outlined in item 1 above for other academic activities as established by the institution including laboratory work, internships, practica, studio work, and other academic work leading to the award of credit hours.

To this end, all students in courses offered by the Department of Mathematics and Statistics that wish to be successful should plan to spend a minimum of two hours outside of class for every credit hour associated with this course. Expected activities to be completed in the time outside of class include reviewing notes from previous class meetings, reading assigned course resources, completing all assigned exercises and projects, and performing periodic assessment preparation.

Course Prerequisites and Corequisites: MATH 3315

Course outline:

<table>
<thead>
<tr>
<th>Approximate time spent</th>
<th>First order Differential Equations</th>
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</thead>
<tbody>
<tr>
<td>15%</td>
<td></td>
</tr>
</tbody>
</table>

- Separation of variables, linear equations
- Qualitative techniques: Slope Fields
- Existence & Uniqueness
- Euler's Method
- Equilibria & the phase line
- Bifurcations

- First Order systems
  - Qualitative Methods
  - Analytic Methods for Special Cases
  - Euler's Method

- Linear systems
  - Properties and the Linearity Principle
  - Eigenvalues, Eigenvectors, Straight Line Solutions
  - Phase Plane
  - Complex Eigenvalues
  - 2nd and Higher Order D.E.’s

- Forcing and Resonance
  - Forcing
  - Sinusoidal Forcing
  - Amplitude and Phase of Steady State

- Nonlinear Systems
  - Equilibrium Point Analysis and Linearization
- Qualitative Analysis
- Hamiltonian Systems
- Discrete Dynamical Systems
- Discrete Logistic Function
- Fixed Points and Periodic Points
- Bifurcations
- Chaos

**Student Learning Outcomes (SLO):** At the end of MATH 3330S, a student who has studied and learned the material should be able to:

1. Solve forced and unforced linear O.D.E.'s and linear systems of O.D.E.'s either explicitly or numerically. [PLO: 1,2,3]
2. Explain the qualitative long term behavior of a the solutions to an ODE or system of ODE's. [PLO: 1, 2,3]
3. Explain the role that eigenvalues and eigenvectors play in the solutions to linear ODE's and linear systems. [PLO: 1, 2,3]
4. Solve a nonlinear system qualitatively by equilibrium point analysis and the phase plane. [PLO: 1, 2, 3]
5. Demonstrate understanding of the relationship between continuous differential equations and discrete difference equations. [PLO: 1, 2,3]
6. Demonstrate understanding of the relationship between periodic solutions and chaos. [PLO: 1, 2,3]

**Program Learning Outcomes (PLO):** Students graduating from SFA with a B.S. Degree and a major in mathematics will:

1. Written Communication - SFA Mathematics majors communicate mathematical ideas effectively in written form, integrating mathematical notation correctly and consistently.
2. Verbal Communication - SFA Mathematics majors communicate mathematics effectively to diverse audiences.
3. Mathematical Maturation - SFA Mathematics majors grow from a computational understanding of mathematics to an integrated approach which includes critical thinking proficiency, computational facility, conceptual understanding, and problem-solving persistence.

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www.sfasu.edu
Acceptable Student Behavior

Classroom behavior should not interfere with the instructor’s ability to conduct the class or the ability of other students to learn from the instructional program (see the Student Conduct Code, policy 10.4). Unacceptable or disruptive behavior will not be tolerated. Students who disrupt the learning environment may be asked to leave class and may be subject to judicial, academic or other penalties. This prohibition applies to all instructional forums, including electronic, classroom, labs, discussion groups, field trips, etc. The instructor shall have full discretion over what behavior is appropriate/inappropriate in the classroom.

Date of document: 08/23/2023